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## TWO TYPES OF VARIABLE PUBESCENCE ON PLANTS

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Pubescence on plants has long been made use of by systematic botanists as a character upon which species are frequently based, wholly or in part. In instances in which this combined with other constant characters it may be of value, but observations in the field and herbarium covering a long period of years have led to the belief that in a much larger proportion of cases than is suspected pubescence has been a delusion and a snare to the systematist. To most systematists doubtless a hair is a hair unless these differ noticeably in structure, size, or abundance, and little or no thought is given to the function of hairs or their possible lack of diagnostic value.

It is probable that all pubescence on plants, and perhaps glaucescence, may be divided into two classes, viz.: functioning and non-functioning. As an example of the latter class may be cited the well-known and extremely variable *Paspalum floridanum* Michx., in almost any patch of which one may find at least six forms as follows:

1. Plants with only the basal leaves and sheaths pubescent.
2. Plants with the basal leaves and sheaths and the sheaths of all cauline leaves pubescent.
3. Plants with all leaves and sheaths pubescent.
4. Plants with all leaves and sheaths and the stem pubescent as far as the rachis.
5. Plants pubescent to the tip of the inflorescence.
6. The more glabrous forms are in some cases glaucous.

In this species at least, the pubescence may be the result of a mutation and does not vary throughout the season. At least it does not appear to have any definite function. What would be the results of a study of the progeny of each form is uncertain, but probably the majority of the offspring would be like the parent with a scattering of all of the other forms.

In plants with functioning pubescence are found greater possibilities of deception to the systematic botanist than in the former. It has long been observed that the leaves of certain plants lose their

pubescence with age and that leaves of other plants have one form of pubescence in the spring succeeded by a somewhat different kind of pubescence at maturity, but I do not know of attention having been called to any having glabrous leaves, and leaves with one and some with two forms of pubescence on a single individual at the same time. During the latter part of 1913 there was received for study, through the Office of Foreign Seed and Plant Introduction and Distribution, about thirty sheets of Chinese chestnuts (*Castanea*) collected by Mr. Frank N. Meyer in the province of Chi-li. They were accompanied by a lot of burs which were collected on a different date than any of the specimens, which were from two or three localities, so there was no reason to suspect that all belonged to the same species, especially as the leaves presented noticeable variations in size, pubescence, and dentation. Tentatively these were divided into three species and an unsuccessful attempt made to locate them among those previously described; but the absence of inflorescence and definite knowledge as to which of the specimens, if any, the burs were to be associated with, prevented any positive identifications. As the seed with this material was sent for propagation, with the expectation that it would prove resistant to the Chestnut Blight, Messrs. J. Franklin Collins and R. Kent Beattie, who were investigating this disease, went over the material and verified my tentative conclusions. Later, photographs of types from European herbaria and all of the Chinese *Castanea* from the Arnold Arboretum having been obtained, the material was again gone over with Messrs. Collins and Beattie without very satisfactory results, but with the firm conviction that three or more species were represented.

Learning from Mr. Collins that two trees propagated from the seed received were growing upon Mr. David Fairchild's place at North Chevy Chase, Md., where they had been inoculated the previous season, a joint inspection of the trees was arranged and all of the available type photographs and herbarium material taken along for comparison, with the following results.

1. Practically every form and size of leaf and variation in pubescence and dentation represented in the photographs of type material of *Castanea mollissima* Blume from the Paris and Leyden herbaria, and in the herbarium material from northern China, were found on the two trees which were grown from the same lot of seed. Furthermore the seeds from which the two trees grew probably were produced on the same tree in China.

2. All the leaves on the south side of the trees receiving the greatest amount of direct sunlight were densely velvety-pubescent beneath with stellate hairs thickly interspersed with long jointed hairs, the amount of pubescence gradually decreasing towards the base of the branch as the lower leaves received an increasing amount of shade from those above, the lowest leaves being practically glabrous.

3. Leaves on the north side of the tree receiving a minimum amount of sunshine showed practically no pubescence except at the tips of the youngest unfolding leaves which had a few of the long jointed hairs and an occasional stellate hair. Leaves on the east and west sides showed intermediate amounts of pubescence.

4. Leaves on short branches arising from the very base of the tree, and in deep shade at all times due to its low dense branching habit, were practically glabrous, or with a very few short jointed hairs along the midrib beneath. The leaves were also much smaller and of somewhat different shape and proportions from those on any other parts of the tree.

From the above facts, which have been further verified by an examination of plants growing at the Arnold Arboretum and by statements by Mr. Meyer since his return from China, it can only be concluded that *Castanea mollissima* is an extremely variable species and that in this species at least pubescence functions primarily as a protection to the young growing leaves from excessive transpiration and is of no diagnostic value. There has been no opportunity to study living material in the fall, but from herbarium material it may be concluded that most of the pubescence is lost by that time. It can not be argued that leaves on the tree without much pubescence are older than those that are densely pubescent and have lost their pubescence through age, because the youngest growing leaves, which would be the ones to be pubescent if any, are practically glabrous on the north side of the tree if protected at all. On the other hand those on the south side are densely pubescent in every case, unless growing on short branches near the trunk and entirely shaded by leaves on the longer branches above.

These facts serve to show the necessity for a more careful study of growing plants and the ease with which a systematist working with herbarium material alone may be deceived as to the diagnostic value of certain characters. In many instances living wild plants at points a few hundred miles apart which are apparently distinct will be found

to have several intergradations in the intermediate territory. Doubtless all manuals of botany contain many overlooked cases of this kind, and specialists are even accused of describing two species from different parts of the same tree. While the unnecessary multiplication of species is to be regretted, it is manifestly impossible for but few systematists to compare critically many related species from growing material and the difficulties of the authors of manuals are far greater. It is, however, urged that all botanists give more careful attention to observations of this character in the field and that a greater amount of discriminating collecting be done with respect to variations occurring upon individual plants. A very large number of descriptions in the manuals of botany make no mention of the color of the flowers or of conspicuous root characters. As the descriptions in these manuals must of necessity be largely drawn from dried and often inadequate, or discolored specimens, but little improvement in the descriptions can be expected until herbaria are supplied with field labels giving the necessary data.

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